

Mars



LEARNING OUTCOMES

After completing this chapter, you should be able to:

- State facts about Mars' environment.
- Describe reasons for scientists' interest in Mars.
- Identify earlier missions to Mars and what they accomplished.
- Describe the current missions to Mars and their status.
- Describe future missions to Mars.

Mars has been a topic of interest and constant scrutiny lately. Not only has it been a very bright star in the evening sky but two probes recently landed on Mars and have been exploring it for a couple of months. Read on and see the latest news about the intriguing planet, Mars.

A Bright Star

In August of 2003, if you looked up into the night sky you probably noticed something a little different; perhaps there was a brighter object out there. That object would have been Mars. Mars was closer to Earth in August than it had been for 60,000 years. On August 27, 2003, Mars was actually closer than 35 million miles from Earth. Normally, Mars is 50 to 60 million miles from Earth.

Of all the planets in our solar system, probably the one that has most mystified and intrigued scientists and non-scientists, has been Mars. Probably more books have been written, movies made, and research conducted on Mars than any of our other neighboring planets. People were fascinated by H. G. Wells popular book *The War of the Worlds*. The book introduced us to Mars and its creatures, and so did the famous movie of the same name, based on Wells' book. So, why so much curiosity about Mars?

Many folks have heard Mars referred to as the angry red planet, and I think the visible redness of Mars adds to our fascination. However, not discounting any of the above, I believe that Mars intrigues us most because there is still expectation



Earth Mars Orbit (NASA Photo)

that life could exist on Mars.

Before we discuss the latest missions to Mars, and the continuation of exploring the possibility of life on Mars, let's review some of the facts about Mars.

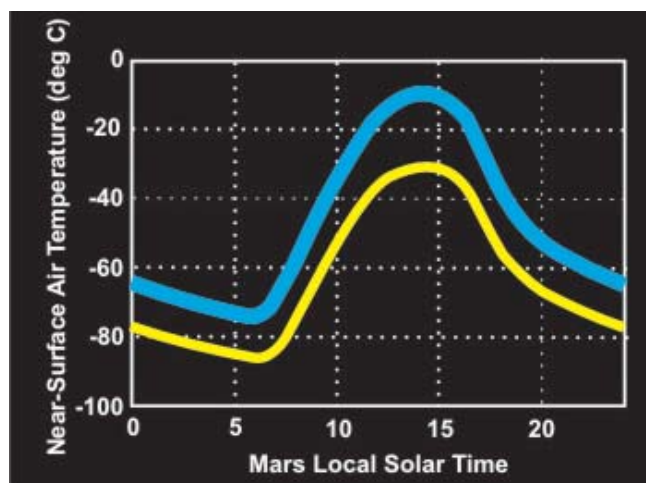
Mars' Facts

Mars is the fourth planet in our solar system from the sun. It appears as a reddish light when viewed with the naked eye at night. This reddish

color stems from the rocks and dust covering the surface of Mars. The surface has a high iron content that gives it a rusty look. The surface of Mars is very dry and rocky and covered with this red-dish dust.

Mars' atmosphere consists of 95% carbon dioxide, 3% nitrogen and traces of oxygen, carbon monoxide and water. Daytime temperatures reach 65 F, while nighttime temperatures can dip to -130 F. These temperatures were recorded from Mars' surface. One day on Mars lasts 24 hours 37 minutes. A year on Mars lasts 687 Earth days.

The characteristics of Mars are closest to Earth's of any of the planets in our solar system.



Graph shows near surface temperature on Mars.
(Information copied from NASA photo)

Some scientists believe that conditions are right for life on Mars. Some scientists think that pools of frozen or liquid water may be hidden underground. The North and South Poles of Mars are covered with permanent ice caps that are made mostly of carbon dioxide (dry ice) and water ice. In summer, much of the carbon dioxide sublimates, leaving a residual layer of water ice.

Past Expeditions

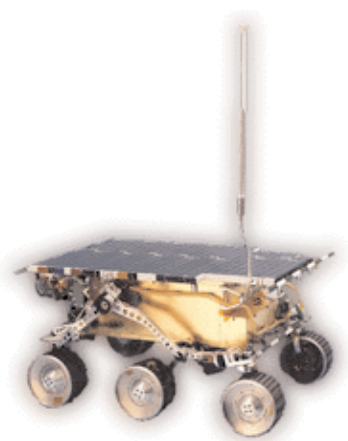
In the 1960s, Mariner spacecraft made flybys and took lots of photos of Mars. Then, in the 1970s, *Viking 1* touched down on Mars. Unfortunately, the experiments were inconclusive even though more water was found on Mars than had been expected.

In July 1997, the space probe, Mars Pathfinder, landed on Mars. The Pathfinder's rover, Sojourner (two feet long and one foot tall)

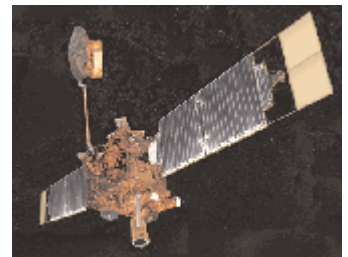
explored the planet. The Sojourner studied the surface, analyzed the soil and rocks and conducted scientific experiments on Mars.

In September 1997, Mars Global Surveyor arrived at Mars and began studying Mars' climate and geology. The Surveyor has been highly successful and has sent back great pictures and information about Mars. In fact, it is still operating on Mars.

From 1998-2000 the Mars Program experienced engineering problems and funding shortages. The Mars Polar Lander and the Mars Climate Orbiter failed to achieve their missions, and the Mars program was restructured. Then in 2001 the Mars Odyssey orbiter was launched.



The Sojourner. (NASA photo)



Mars Global Surveyor
(NASA photo)

Current Missions

In June 2003, the European Space Agency (ESA) launched the Mars Express Orbiter and the Beagle 2 Lander, which was due to land on Mars in late December 2003. The Lander hasn't been heard from for months and an investigation is underway to find out what happened. The results should be reported soon. Once on Mars, the Beagle 2 was supposed to study the surface of Mars and collect rock samples. The Beagle 2's equipment included two cameras, two spectrometers, and a microscope. Samples were to be examined by an automated minilab and relayed back to Earth. As of the middle of March 2004, the Beagle 2's status



Mars Rover Opportunity
(NASA photo)



First Color Picture of Mars surfac. (NASA Photo)

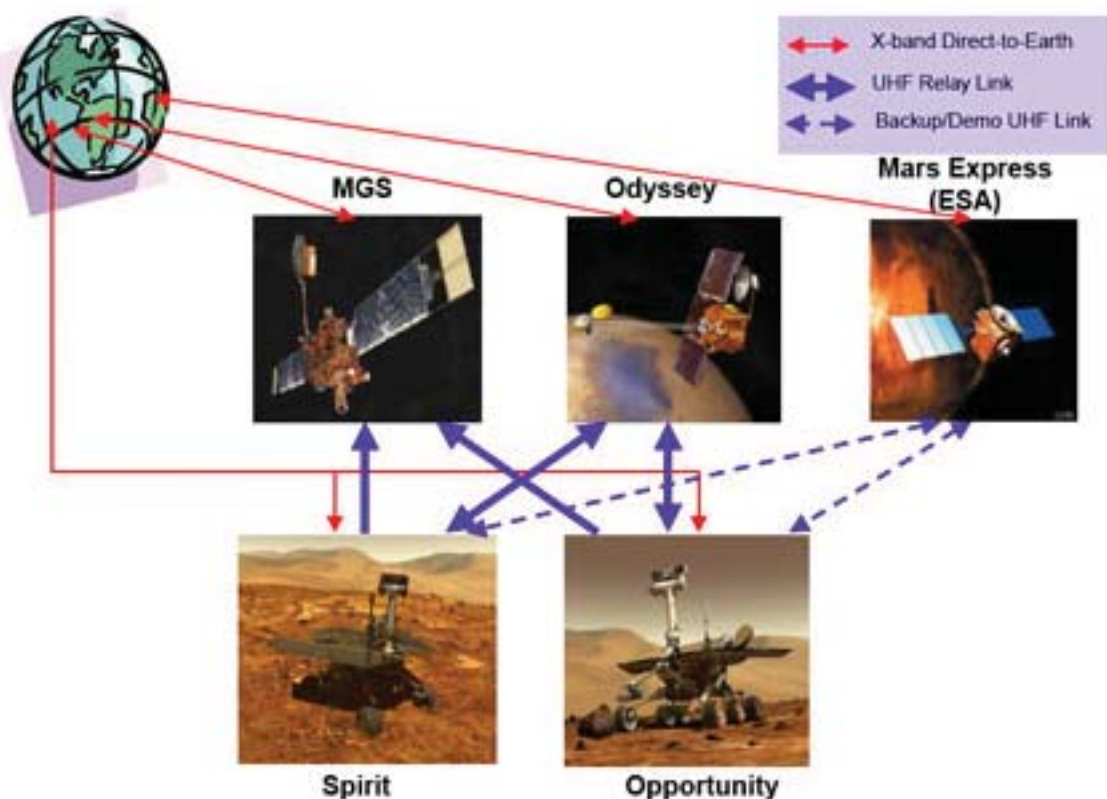
is still unknown.

Also in June-July 2003, the US launched two Mars Exploration Rovers, Spirit and Opportunity. These two joined ESA's orbiter, NASA's Mars Global Surveyor and Mars Odyssey, and Japan's Nozomi in the vicinity of Mars in January 2004. Six probes all studying Mars at the same time.

Together they will investigate the evolution of the planet, its internal activity, and its past and present indications of water and life. Not since the Apollo program has such an extensive effort been made to explore a heavenly body.

Spirit landed on Mars on January 4, 2004 and Opportunity landed January 25, 2004. The two rovers will try to determine if water was present on Mars and whether there are favorable conditions for the evidence of ancient life on Mars. These two rovers are designed to cover as much territory in one day as the Mars Pathfinder did during its entire mission.

This pursuit of Mars is scheduled to continue for at least a few more years. NASA announced recently that it selected the University of Arizona's Phoenix missions to launch to Mars in 2007. The university will build a spacecraft that will land on the planet's northern pole, an area rich in water ice. So, the study of Mars is not going away, until scientists can reasonably answer the questions about water and life on Mars.



How we communicate with the Mars orbiters and rovers.

Update

This section will update the latest information from Mars.

Since landing on Mars back in January 2004, Mars Exploration Rovers, Spirit and Opportunity have already lasted longer than scientists expected, and these scientists are making the most of it. Back in July 2004, Spirit had already driven more than five times its' mission requirements. Plus, both rovers have found hematite, a mineral that often forms in the presence of water, and scientists have confirmed that water once soaked the site where Opportunity landed.

Both Spirit and Opportunity have found evidence of past liquid water, and the more they look the more they find. Opportunity has established that its exploration area was wet a long time ago, and Spirit found bedrock that had been extensive-

ly altered by water. Scientists believe that even the freshest-looking rocks have been altered by water. Scientists have been so optimistic that they were given a six-month extension on the rovers' mission. Given that the rovers have already lasted well beyond their expectancy, scientists pledge to work very hard while the rovers last.

While scientists continue to work with information from the rovers, they are also looking forward to the Mars Reconnaissance Orbiter's arrival near Mars. This orbiter will begin orbiting around Mars in 2006 and will provide detailed images, maps and atmospheric data to help the mission planners of the Phoenix. The Phoenix is the next scheduled lander on Mars. That is due to happen in August 2007.

Activity Section

Activity One

Build Your Own Mars Pathfinder Spacecraft Model

Download the cutouts below, print and construct the model. You will need scissors, tape and/or glue to put it together, and colored markers or pencils to finish it up.

Download Instructions:

Method 1

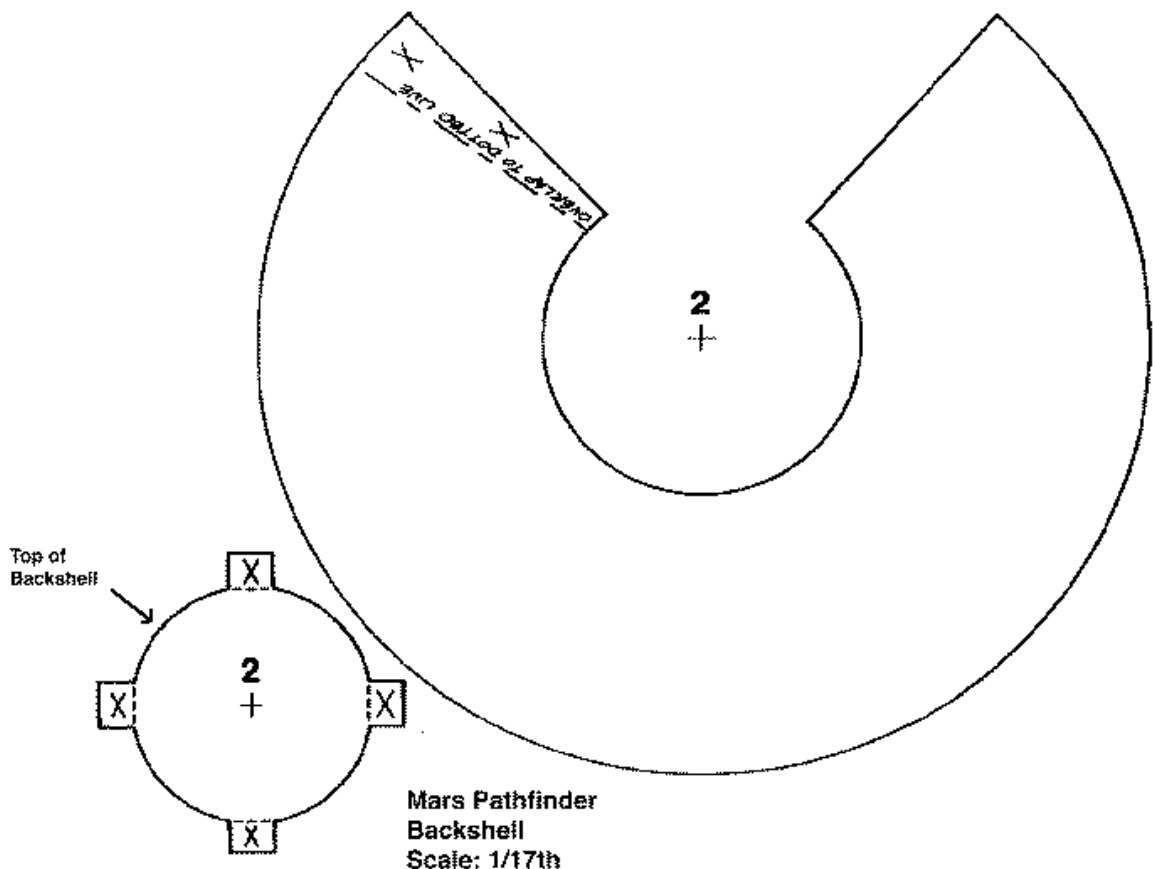
1. Click on the image.
A larger version of the image will be displayed.
2. From your browser's menu, select **Save As**.
3. Make sure you save the page Format as **Source**.

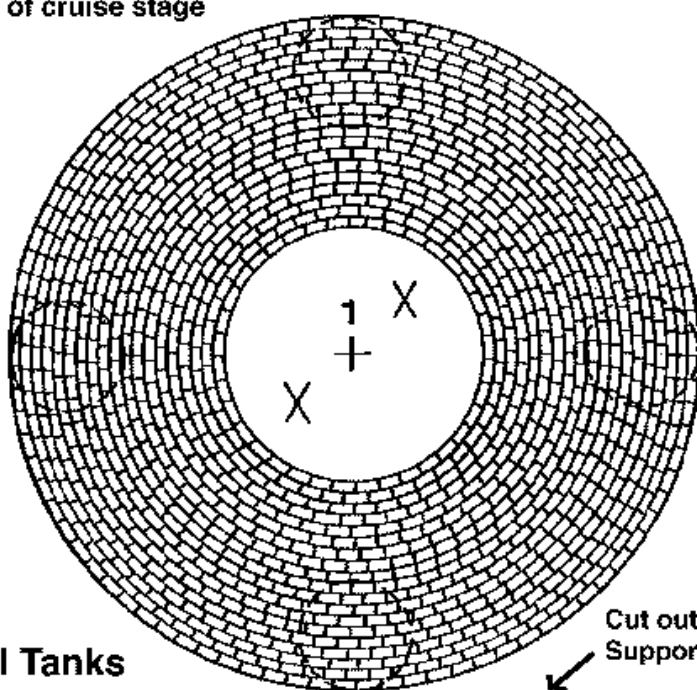
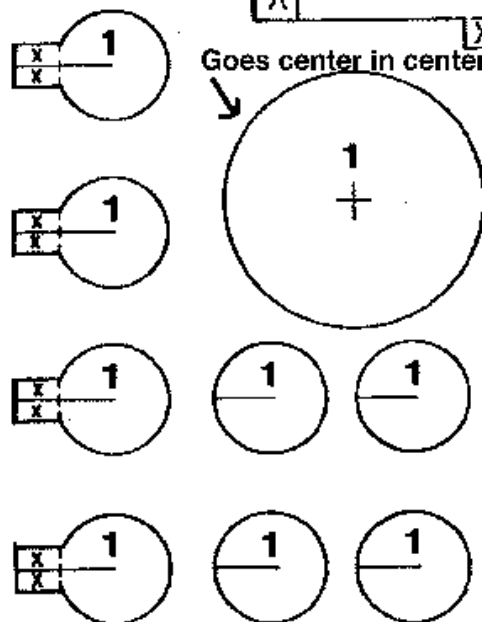
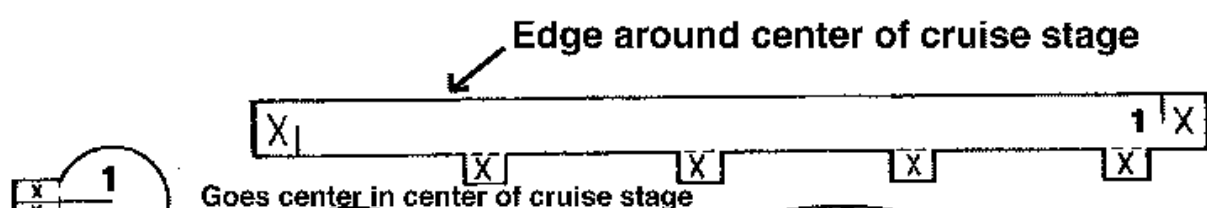
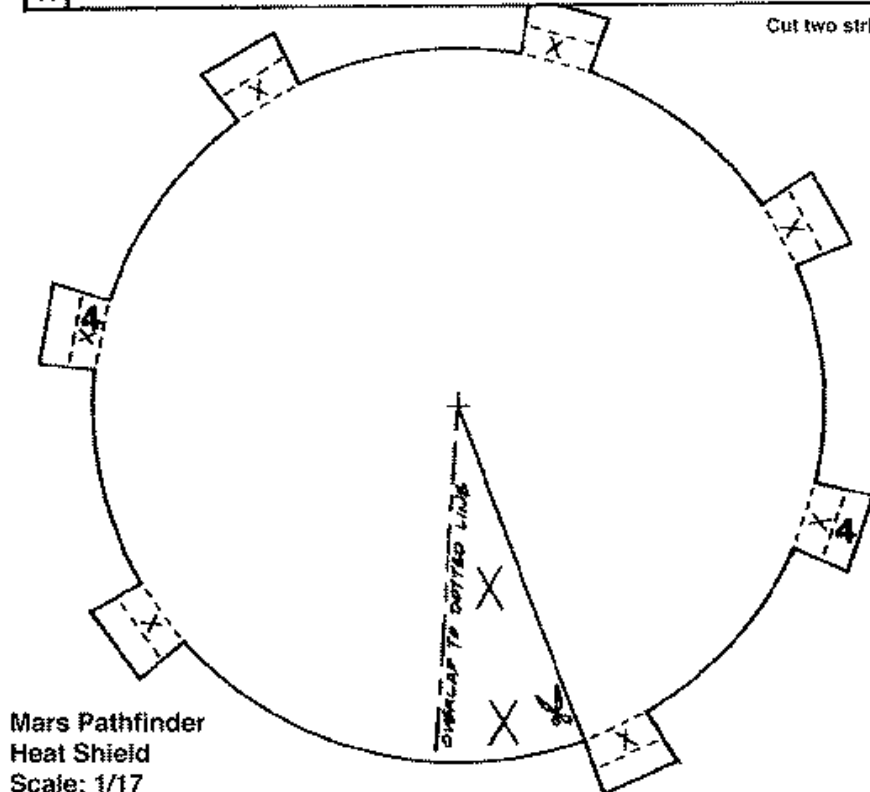
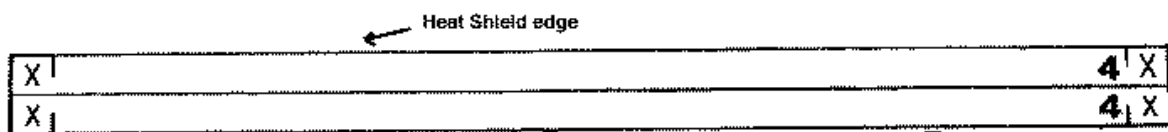
Method 2

1. Click and hold your mouse button on the image (right button on a PC).
2. After a few seconds, a menu will appear.
3. Select **Save this link as**.
4. Make sure to select **source** as the save format.

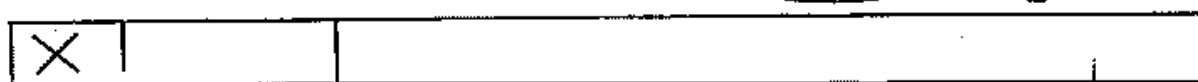
Note: The images you will be downloading are large files. Your download time will depend on the speed of your modem. Smaller, less sharp GIF versions of the images are available below the pictured images. These smaller files will still print out on 8.5"x11" size paper but will have a lower resolution.

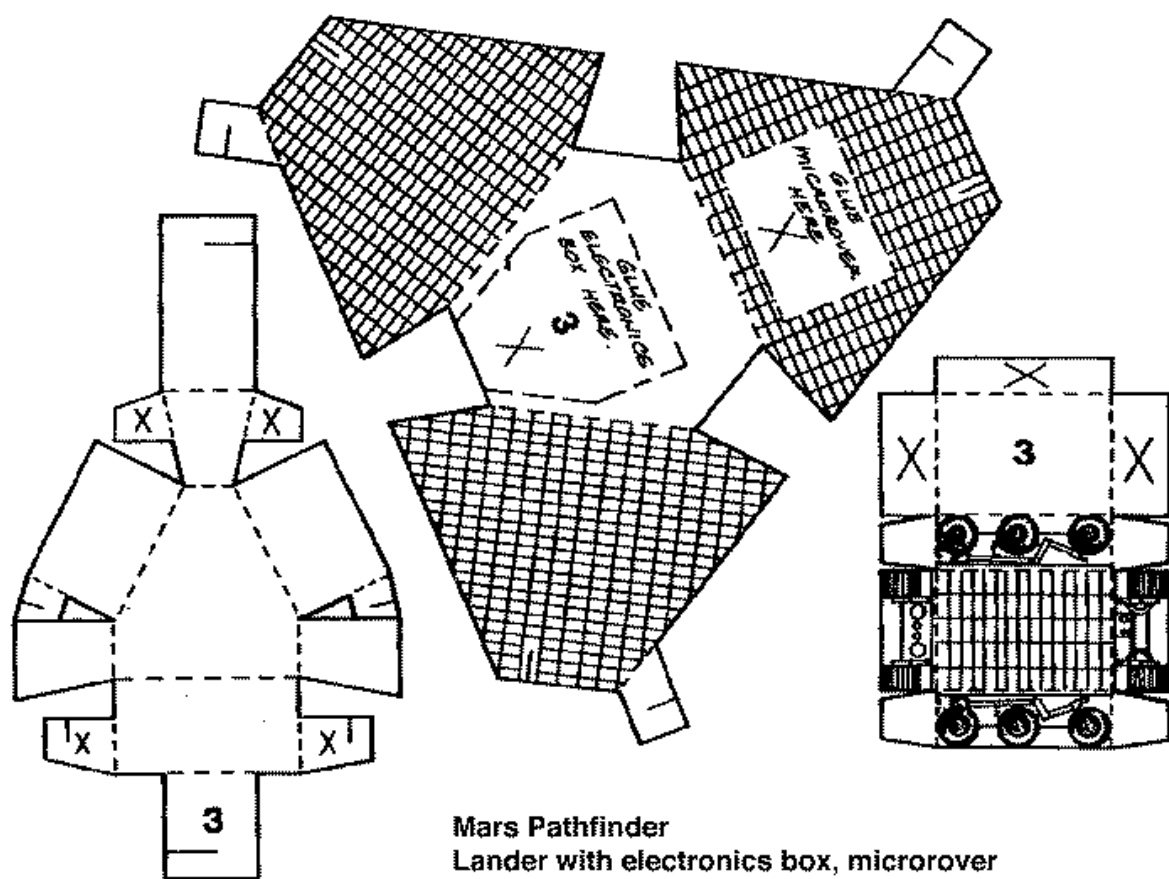
Each image is sized to print on regular 8.5"x11" paper (landscape orientation). Remember, the thicker the stock you print on, the sturdier your model will be!





Cruise Stage with Fuel Tanks





Mars Pathfinder
Lander with electronics box, microrover
Scale: 1/17th